Distribution

- Electricity is supplied to a building by a supply authority. The supply is provided by a cable brought from outside into a suitable point in the building, which is referred to as the **main intake**, and from this the electricity has to be distributed to all outlets which use it. The incoming cable may be a 120 or 150 mm^2 pvc insulated cable and the current flowing along it must be divided between a number of smaller cables to be taken to the various final destinations throughout the building. This division is the function of the distributing system.

- The final distribution board or sub-circuits which serve the final outlets. Each final outlet takes a comparatively small current, and it would be impracticable to serve it with a large cable. The final sub-circuits are most commonly wired in 1.5 mm^2 , 2.5 mm^2 and 6 mm^2 cables. A typical scheme is shown diagrammatically in Fig 1.
- The cable from the main intake to a distribution board is known as a sub-main, and it must be rated to carry the maximum simultaneous current taken by all the final sub-circuits on that board.
- The fuses or circuit breakers in the distribution board protect the final sub-circuits, but the sub-main cable also needs protection against short circuits and overloads, and there must be a fuse or other protective device such as circuit breaker at the main intake.

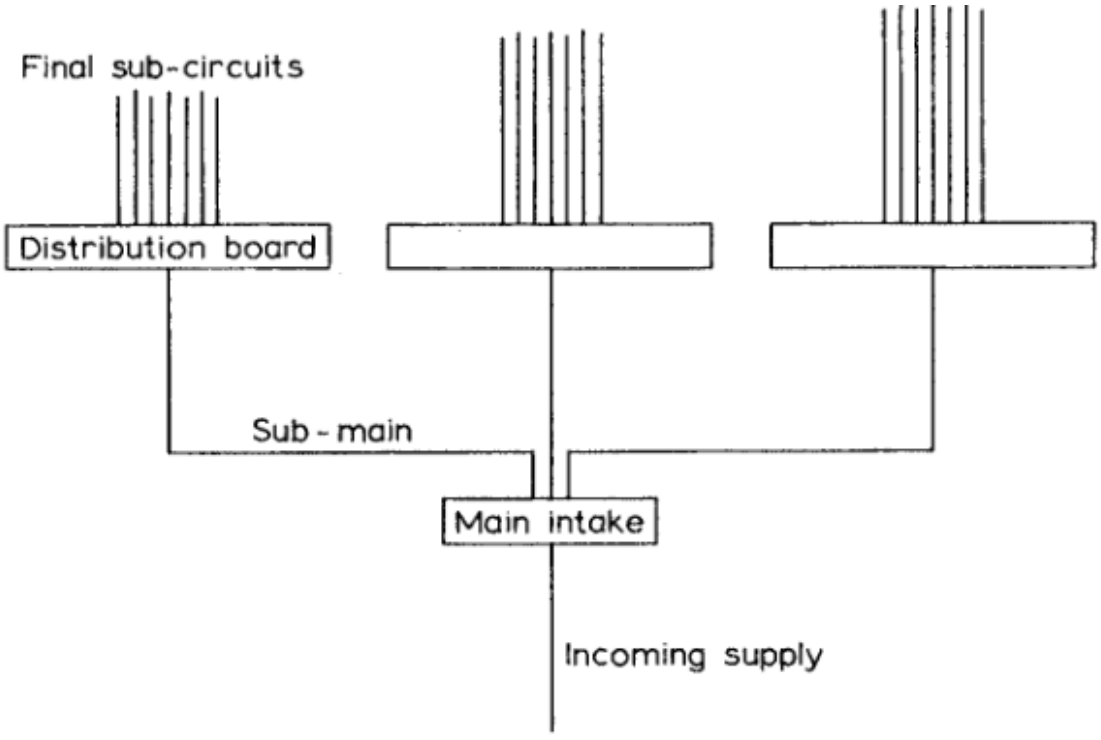


Fig.1

Standard Final distribution board

- Standard distribution boards usually have either 4, 6, 8,9, 12, 16, 18 , 24 , 36 or 42 circuit ways (see Fig.2). Both single and three phase boards are available, the latter having three circuit ways for each outgoing circuit. It is not necessary to utilize all the available circuitways on a board, and in fact it is very desirable to leave several spare ways on each board for future extensions. These are often required before a building is even finished, and are almost certain to be wanted during the life of an installation

Fig.2 Photograph of final distribution board (vertical, split busbar type)

House distribution

The number of circuits in a house is small enough to be accommodated on a single distribution board so that there is no need for sub-main distribution. The scheme thus becomes as shown diagrammatically in Fig.3. The incoming cable goes to a service cut out which is supplied, fixed and sealed by the Electricity Board. As a domestic supply does not normally exceed 100 A the whole can go through the meter and there is no occasion for the use of transformers. From the meter the cable goes straight to the distribution board.

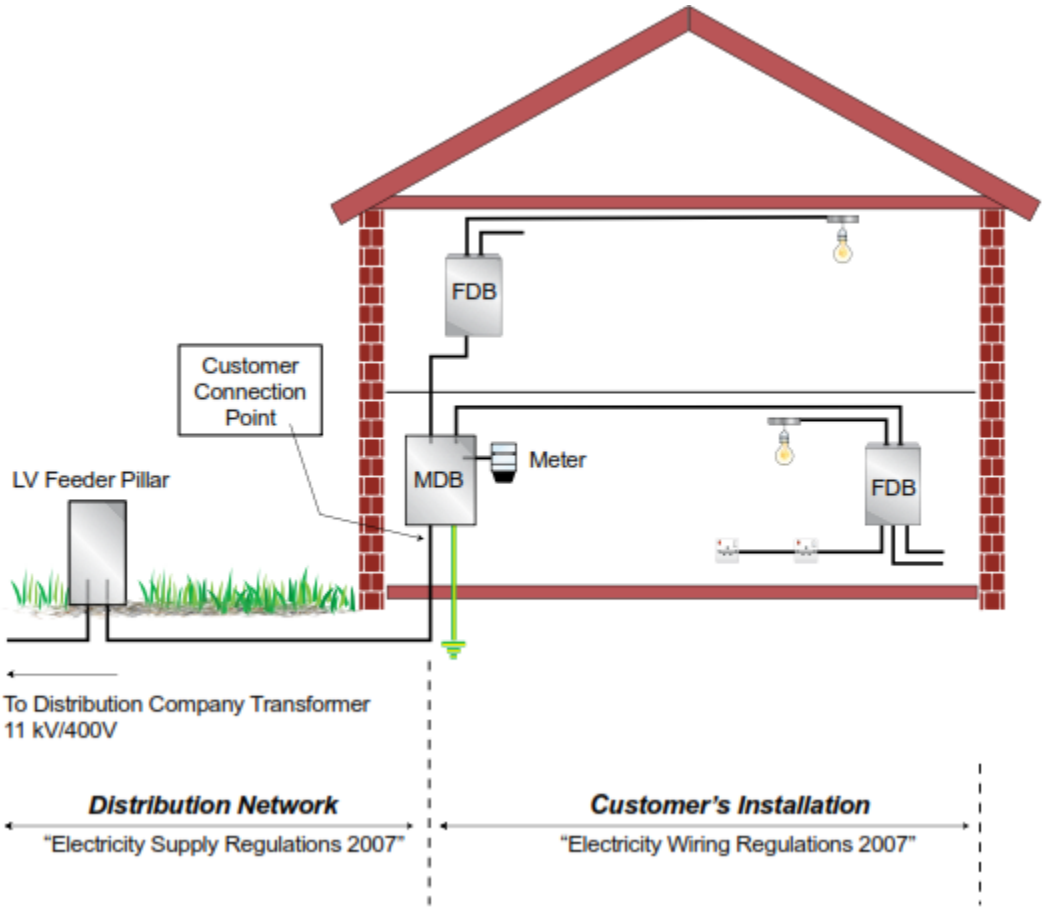


Fig. 3 Domestic service

The M.D.B contain main fuse which is a cartridge fuse, or main circuit breaker. It is installed in the meter board and sealed by the Jordanian Electric Power Company (JEPCO). This main fuse provides further backup protection in case of short circuits.

Watt-Hour Meter:

The Watt-hour meter used in Jordan for all types of installations is of the induction type designed to rotate an aluminium disk which in turn is mechanically coupled to drive a series of pointers or numerals from which the energy consumption is read. It measures the consumed energy over a certain period of time (e.g. one month or one quarter-3 months-) after which the meter is read by the supply authority and the charges calculated.

Energy is measured in joules (Watt-seconds), but for tariff purposes, the larger unit, the kilowatt-hour is used. Fig.4 shows the single phase induction watt-hour meter.

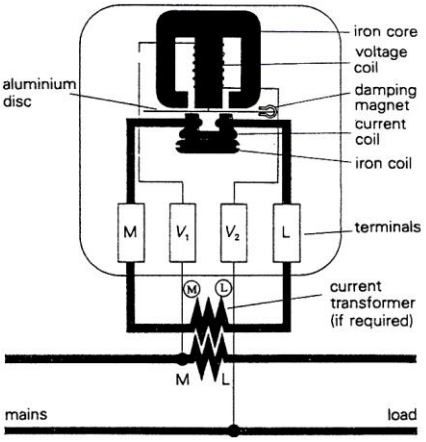


Fig. 4 Watt-hour meter

Main Circuit Breaker:

It is of the single-pole miniature type, it provides protection against overcurrent and short circuits, hence prevents damage of watt-hour meter. It is also installed by JEPCO with ratings depending on load (e.g. 30A, 60A).

Neutral Link:

It is a rectangular piece of drawn copper fitted onto the meter board and connected to the neutral conductor going out of the meter.

Final Distribution Boards (FDB):

The type used here is the M.C.B standard final distribution board; it consists of a prefabricated box of synthetic material of adequate strength, and is fitted on the wall. Fig.2 above.

Each F.D.B contains a phase busbar and a neutral busbar plus an earthing distribution point. The number of M.C.B's is equal to the number of circuits in a dwelling. A double-throw switch (isolator) is used to isolate and connect the D.B to the watt-hour meter. The F.D.B has a metallic cover to protect it from dust and intrusion. On the inside of the cover, there is a single line diagram showing all M.C.B's which are numbered for easy identification. All M.C.B's should be easy to replace.

Minimum number of socket-outlets and connection points in domestic services

Room	Minimum number of outlets for domestic premises
Kitchen:	
13 A switched socket-outlets (worktops)	Minimum 2 double, plus every 2 m of worktop
13 A switched socket-outlets (Appliances)	Minimum 1 single, plus as required for free standing Appliances (e.g. fridge)
Connection points (for washing machine, dryer etc)	Minimum 1, plus as required for number of items installed (flex outlets or socket-outlets)
Cooker control unit	1
Bedrooms	2 double, 1 single
Lounge or dining	3 double, 1 single
Hall or corridor	1 single
Bathrooms	only BS 3535 shaver socket (if required)

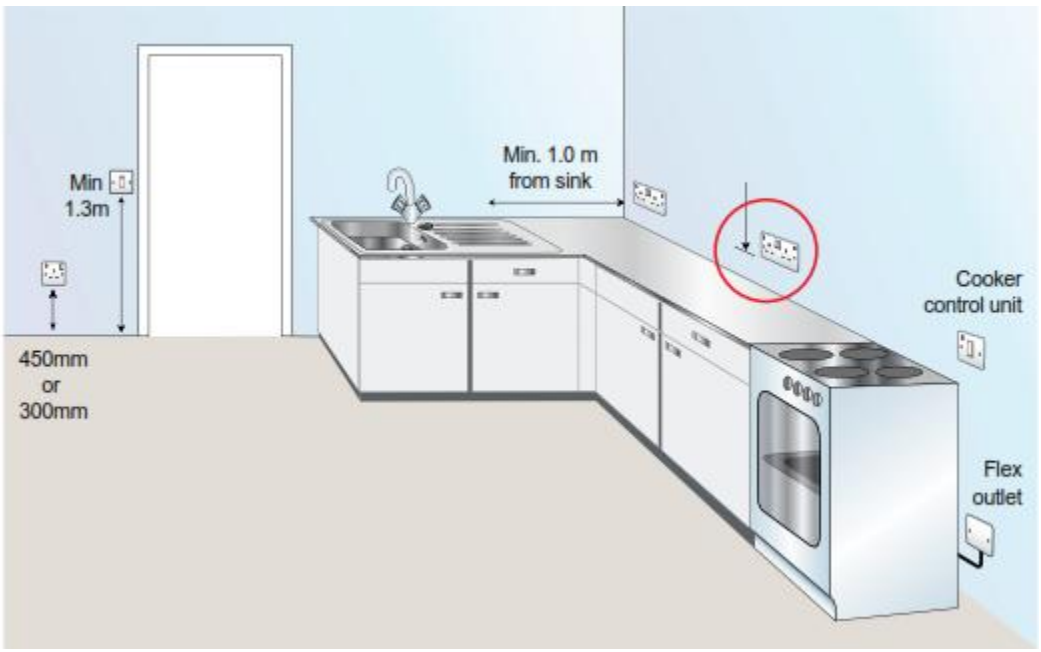
Note 1: in general, double socket-outlets should be used in preference to single socket-outlets wherever possible

Note 2: socket-outlets should be conveniently located to avoid the need for extension cables and adapters (which introduce risk of overheating and fire)

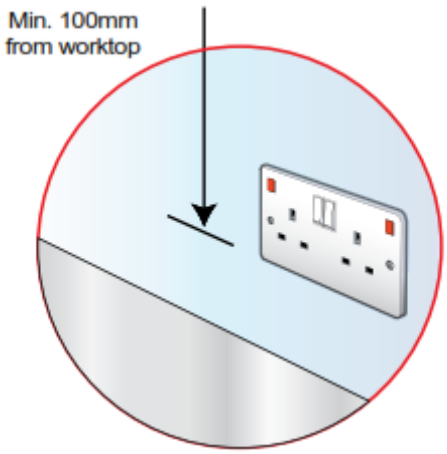
Note 3: 15A BS 546 socket-outlets are not permitted in domestic premises

Note 4: the maximum number of socket-outlets on a Circuit is not limited and is dependent on the load supplied and the wire size .

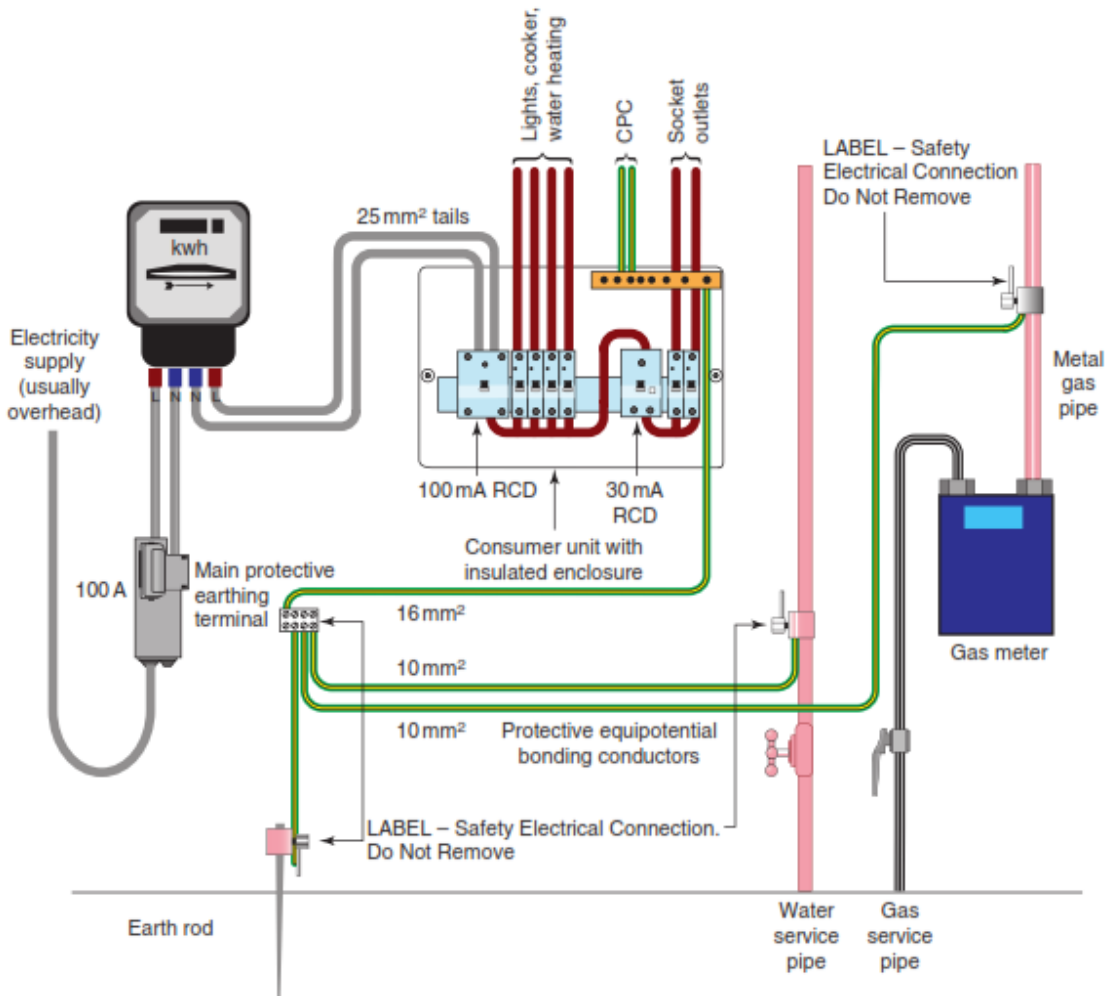
Mounting height for accessories and socket-outlets



Note: Mounting height may be varied for special circumstances such as access for disabled persons or children, etc.



Earthing Distribution: TT system at Domestic premises



TT – Earthing system at House

Flat distribution

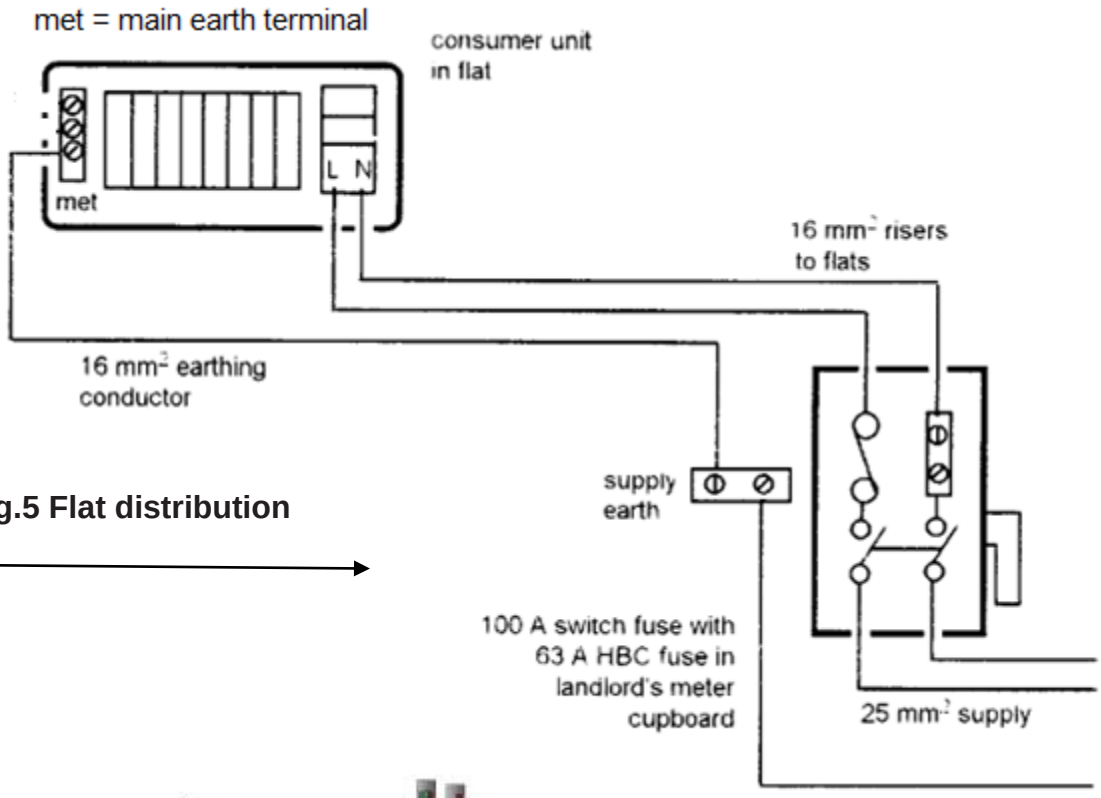


Fig.5 Flat distribution

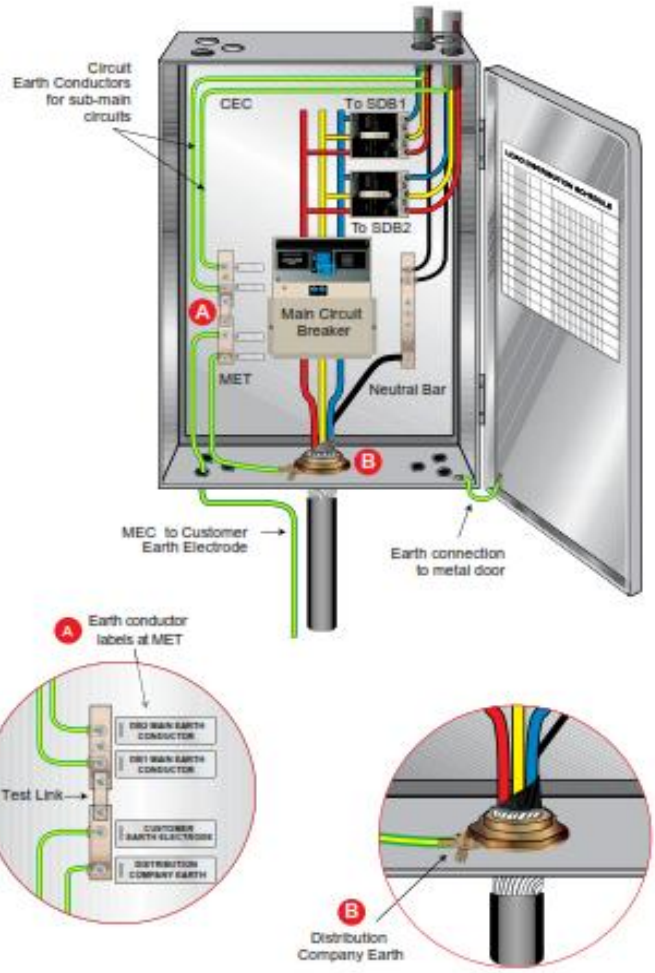


Fig.6 Main earth terminal (MET) at main distribution board (MDB)

Residential and similar premises

Electrical installations for residential premises need a high standard of safety and reliability
The power distribution utility connects the LV neutral point to its MV/LV distribution tranformer to earth.
All LV installations must be protected by RCDs.
All exposed conductive parts must be bonded together and connected to the earth.

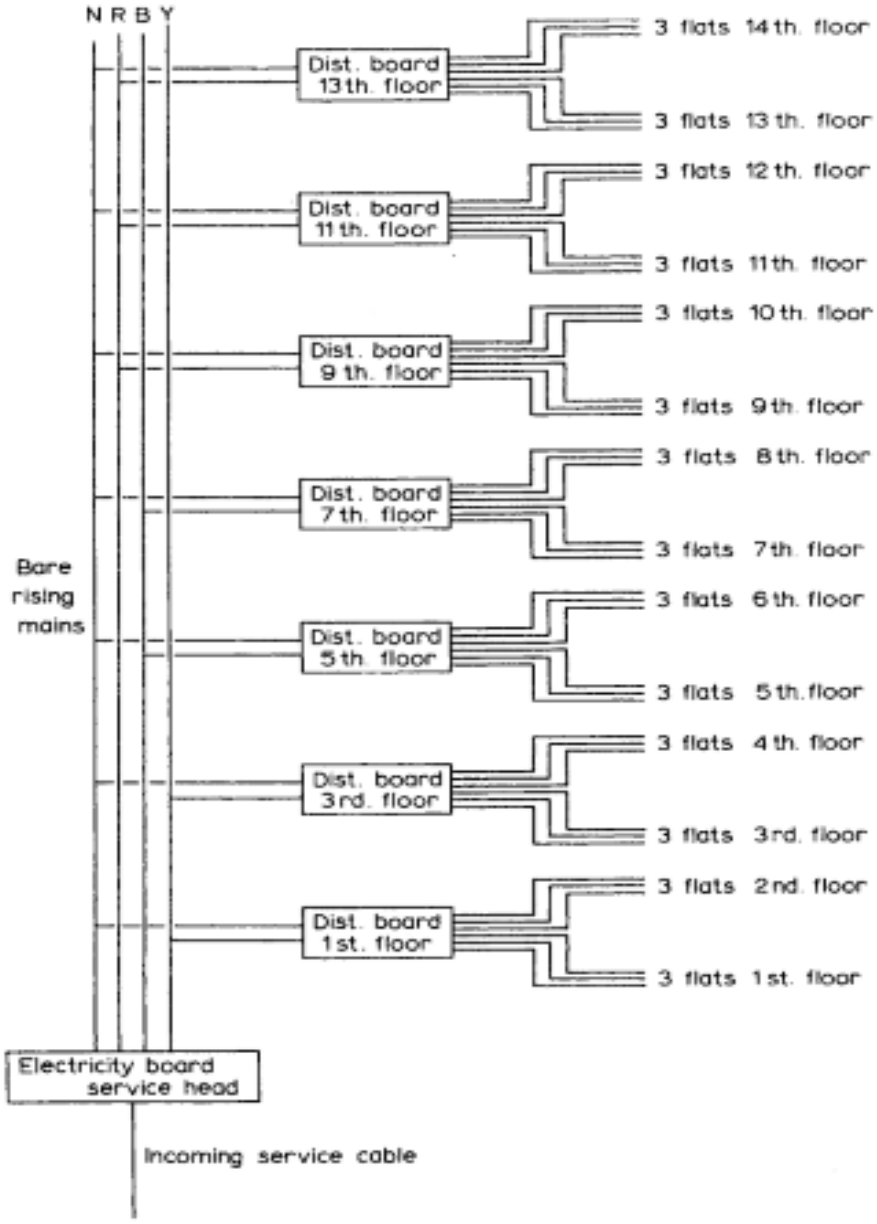


Fig.7 Residential building distribution

Office Building and Large premises distribution

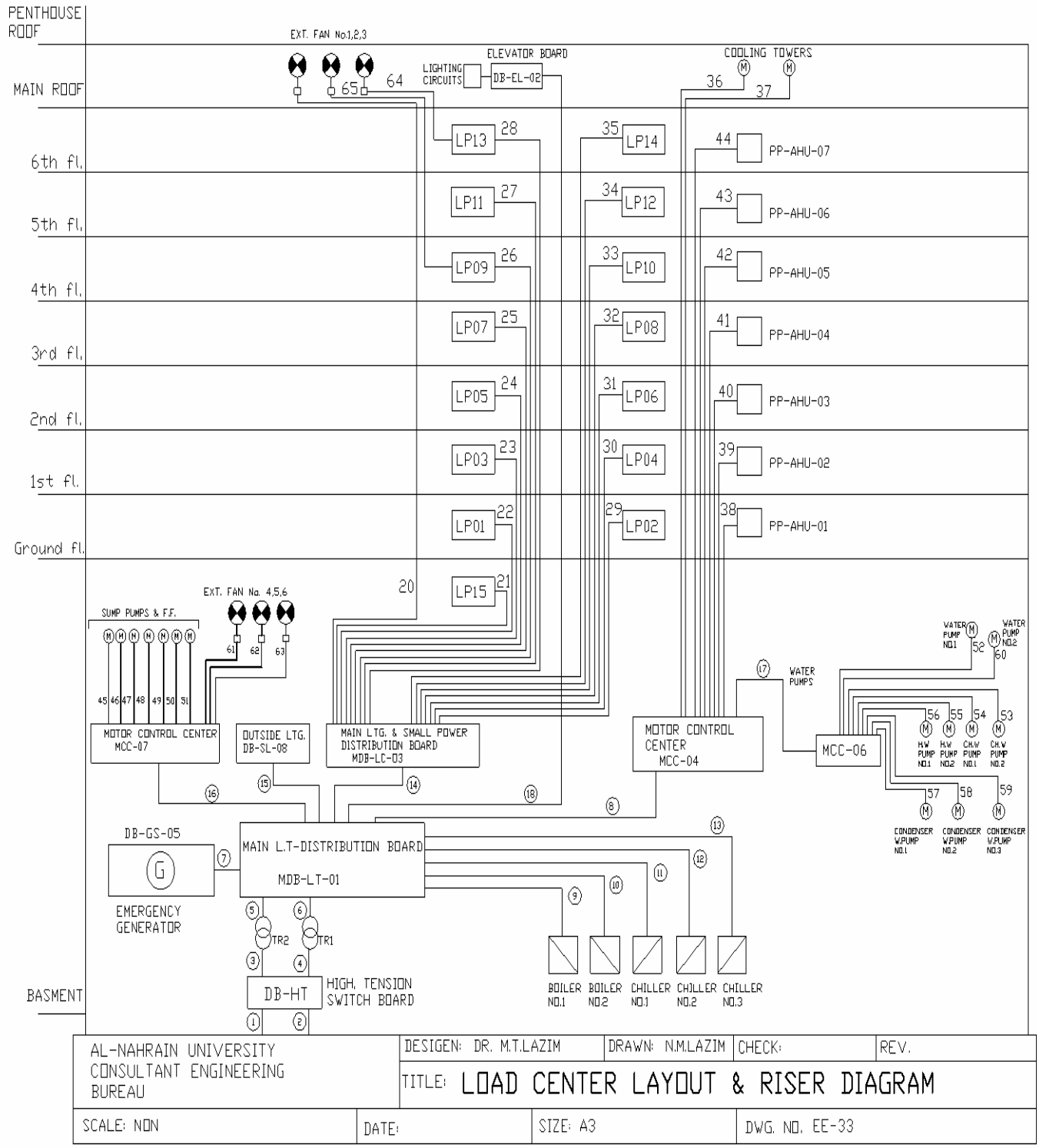
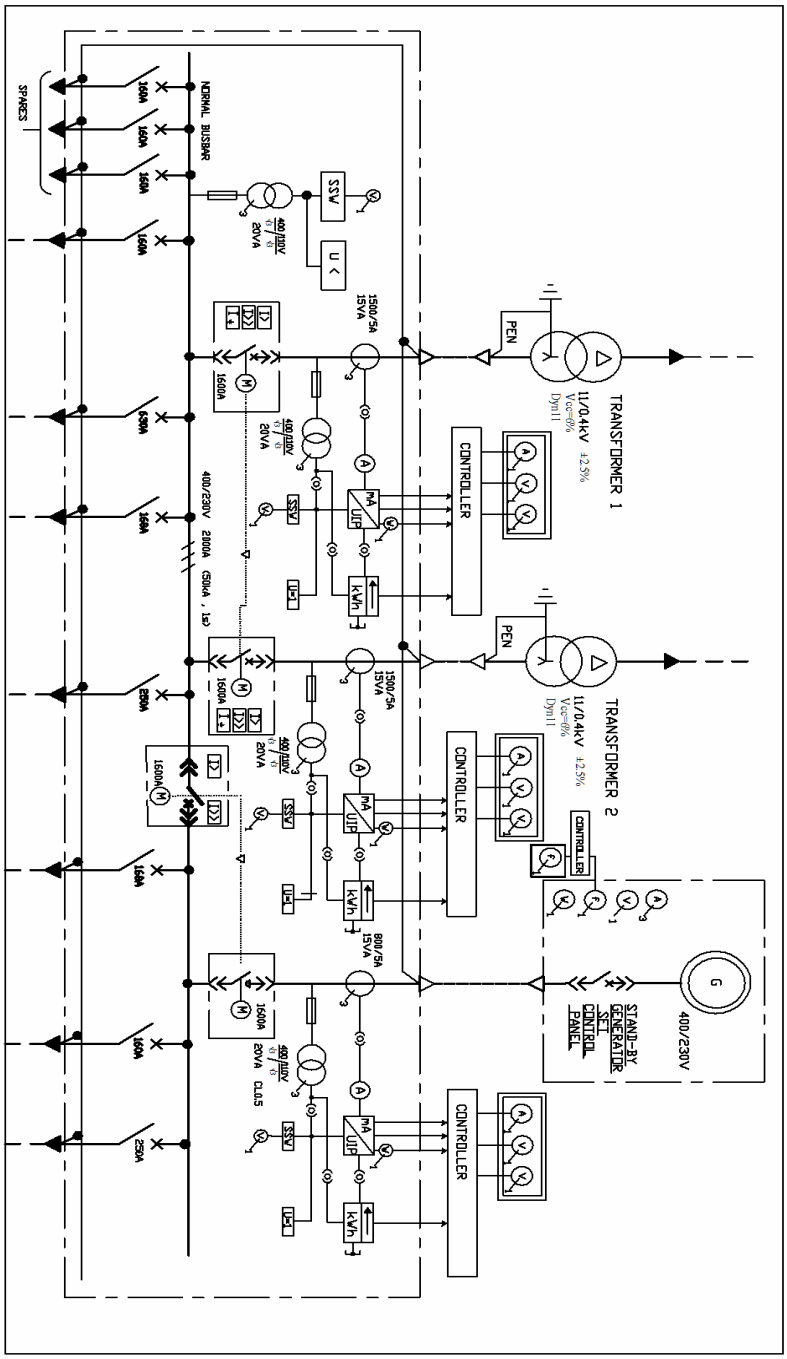


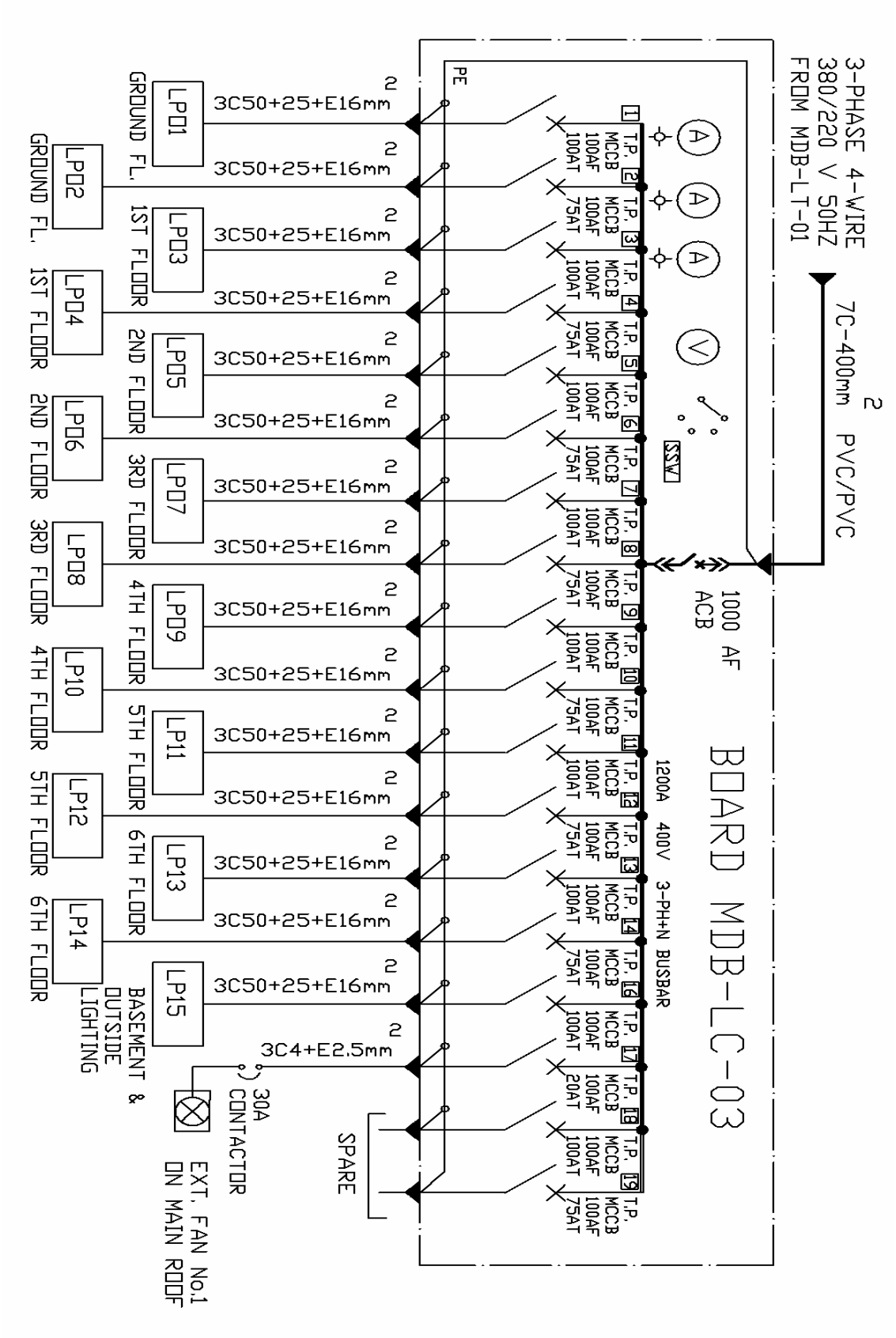
Fig.8 Large building distribution

Types of Distribution Boards in large buildings

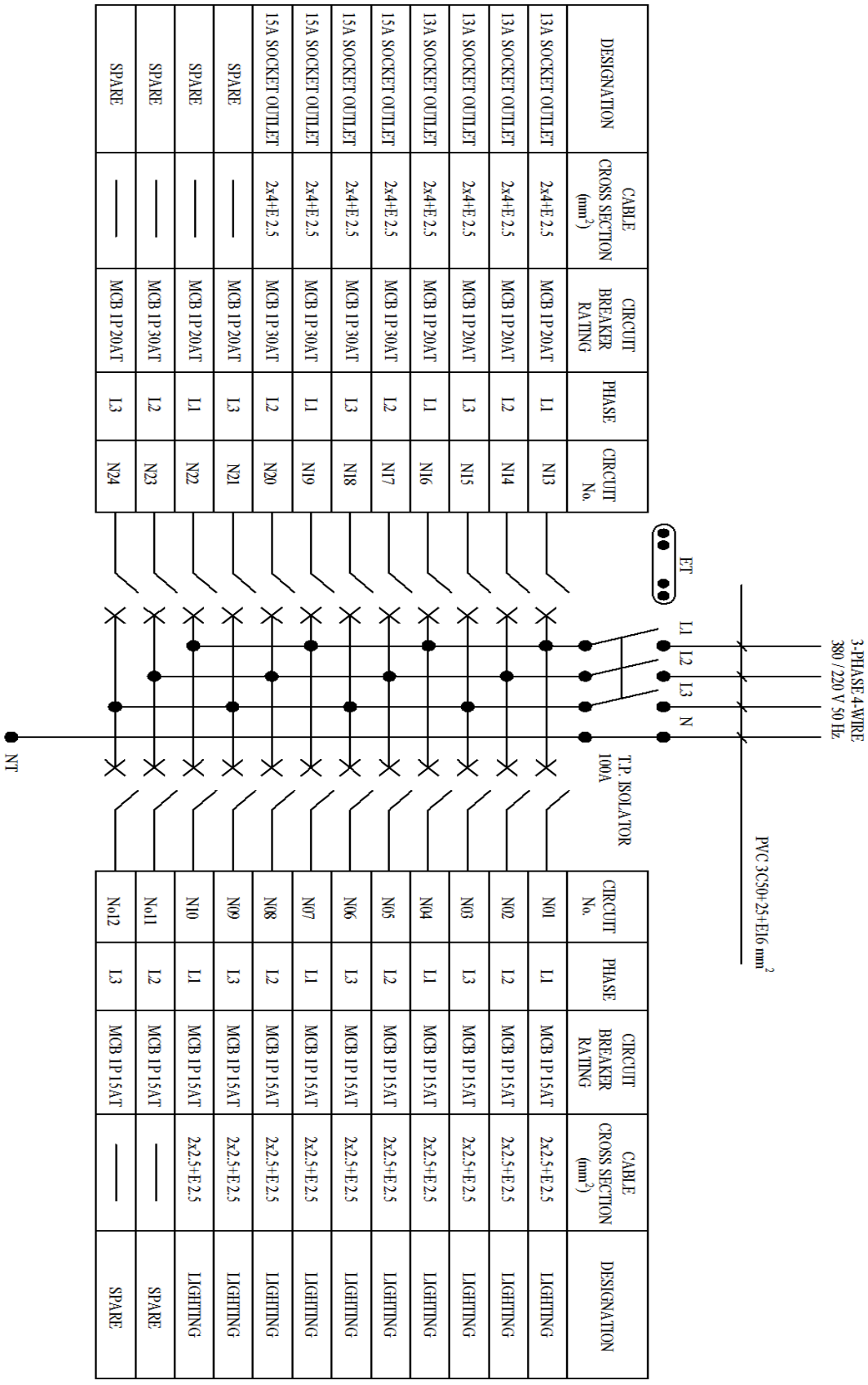
- L.T. Main Distribution Board
- Aux. Main Distribution Boards
- Sub-Distribution Board
- Final Sub-distribution boards
- Branch distribution panels
- Motor Control Centers (MCC)
- Special use distribution boards

L.T. Main Distribution Board

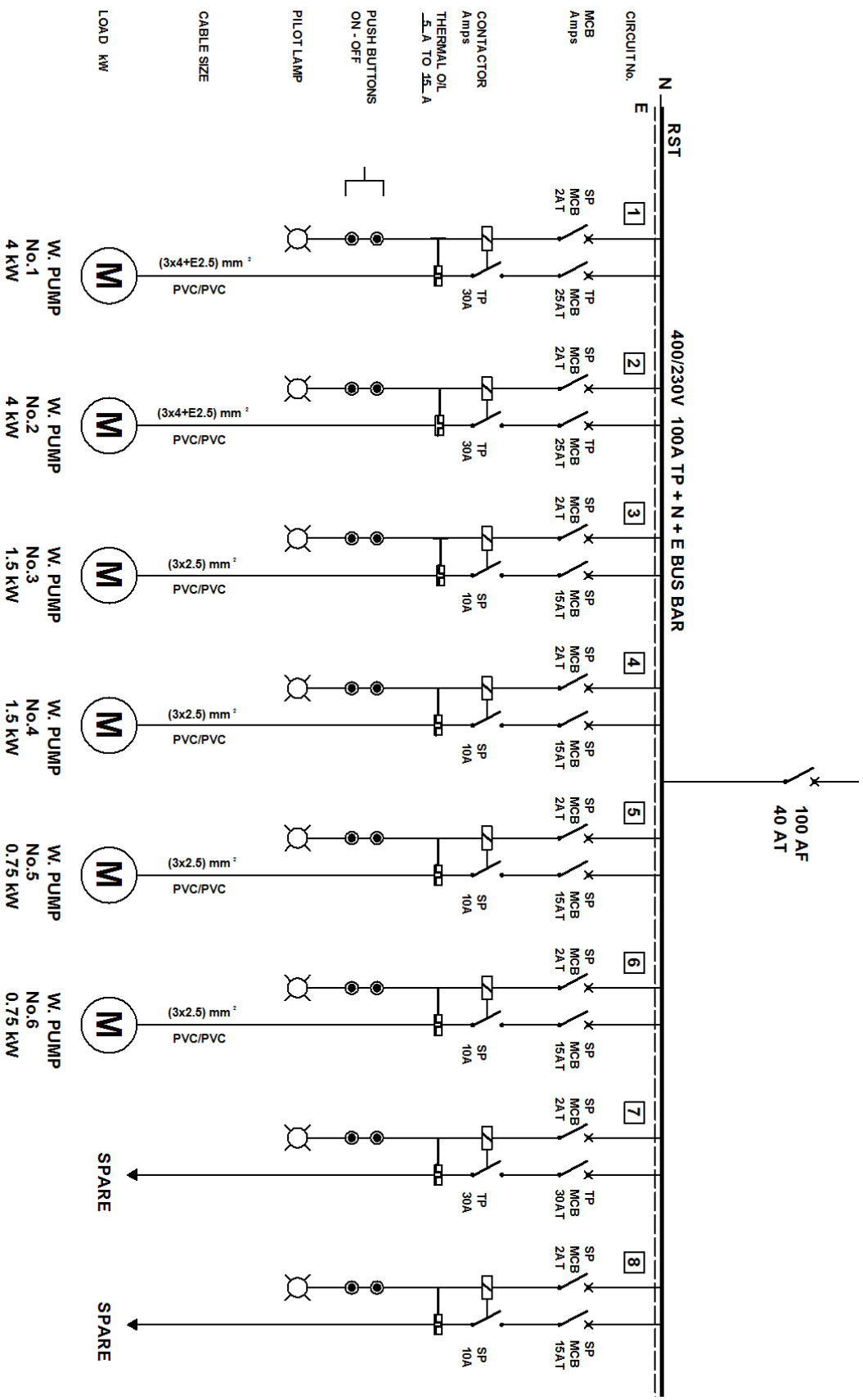




Aux. Main Distribution Boards


3-PHASE 4-WIRE
380 / 220 V 50 Hz
PVC 3C50+25+E16 mm2
ET
L1 L2 L3 N
T.P. ISOLATOR
100A
NT
DESIGNATION
CABLE CROSS SECTION (mm2)
CIRCUIT BREAKER RATING
PHASE
CIRCUIT No.
13A SOCKET OUTLET 2x4+E 2.5 MCB 1P 20AT L1 N13
13A SOCKET OUTLET 2x4+E 2.5 MCB 1P 20AT L2 N14
13A SOCKET OUTLET 2x4+E 2.5 MCB 1P 20AT L3 N15
13A SOCKET OUTLET 2x4+E 2.5 MCB 1P 20AT L1 N16
15A SOCKET OUTLET 2x4+E 2.5 MCB 1P 30AT L2 N17
15A SOCKET OUTLET 2x4+E 2.5 MCB 1P 30AT L3 N18
15A SOCKET OUTLET 2x4+E 2.5 MCB 1P 30AT L1 N19
15A SOCKET OUTLET 2x4+E 2.5 MCB 1P 30AT L2 N20
SPARE —— MCB 1P 20AT L3 N21
SPARE —— MCB 1P 20AT L1 N22
SPARE —— MCB 1P 30AT L2 N23
SPARE —— MCB 1P 20AT L3 N24
CIRCUIT No.
PHASE
CIRCUIT BREAKER RATING
CABLE CROSS SECTION (mm2)
DESIGNATION
N01 L1 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N02 L2 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N03 L3 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N04 L1 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N05 L2 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N06 L3 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N07 L1 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N08 L2 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N09 L3 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
N10 L1 MCB 1P 15AT 2x2.5+E 2.5 LIGHTING
No11 L2 MCB 1P 15AT —— SPARE
No12 L3 MCB 1P 15AT —— SPARE

Three-phase Final Distribution Board



Motor Control Centre (MCC)

INDUSTRIAL DISTRIBUTION BOARDS

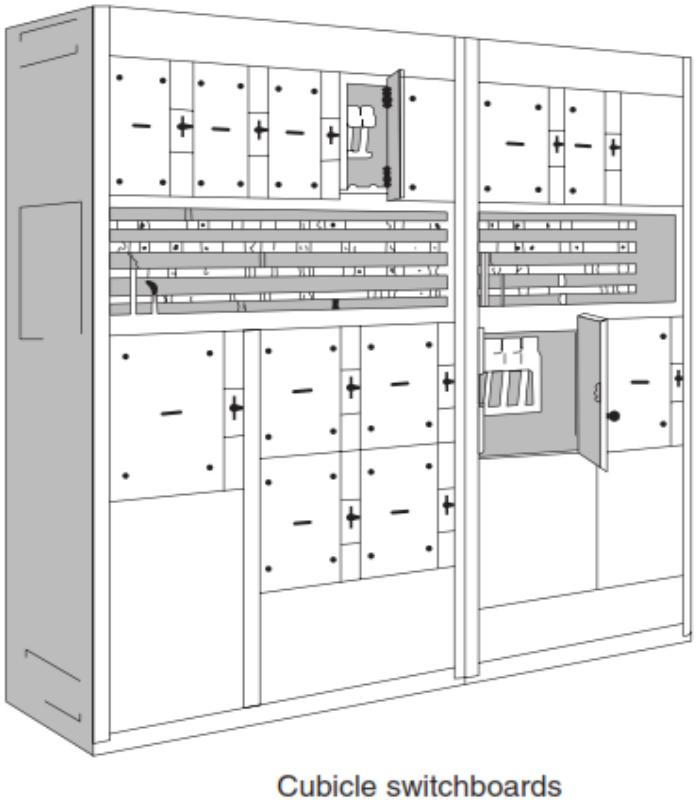


FIGURE . Industrial consumer's service position equipment.

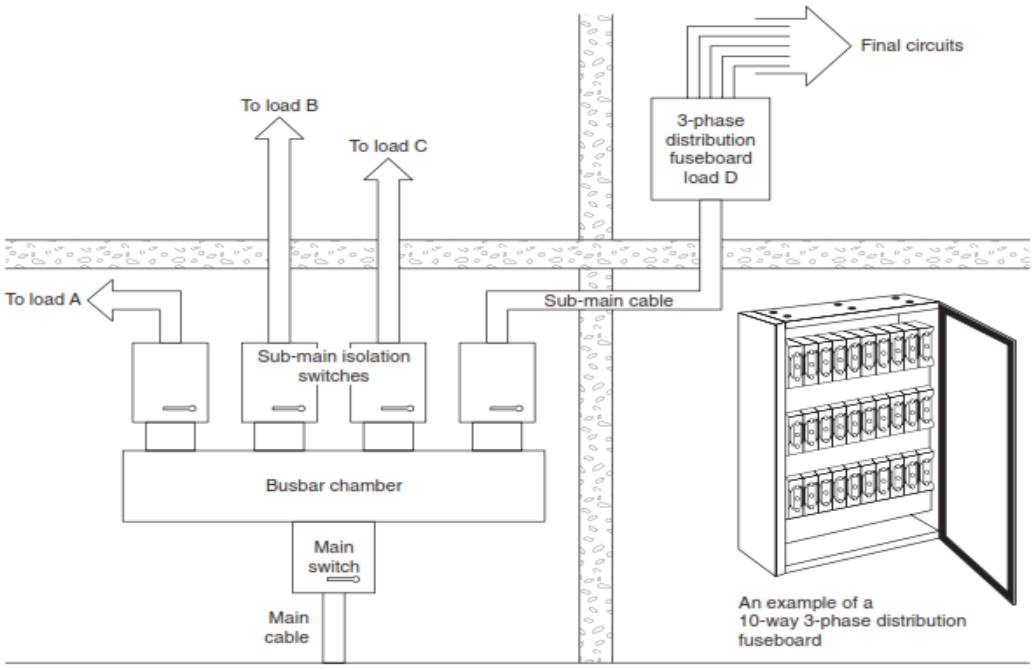


FIGURE .Typical distribution in commercial or industrial building.

DRAWINGS AND DIAGRAMS

Many different types of electrical drawing and diagram can be identified: layout, schematic, block, wiring and circuit diagrams. The type of diagram to be used in any particular application is the one which most clearly communicates the desired information.

1. LAYOUT DRAWINGS OR SITE PLAN

These are scale drawings based upon the architect's site plan of the build-ing and show the positions of the electrical equipment which is to be installed. The electrical equipment is identifi ed by a graphical symbol see Fig.1.
The standard symbols used by the electrical contracting industry are those recommended by the British Standard BS EN 60617, *Graphical Symbols for Electrical Power, Telecommunications and Electronic Diagrams.* Some of the more common electrical installation symbols are given in Fig.2 .

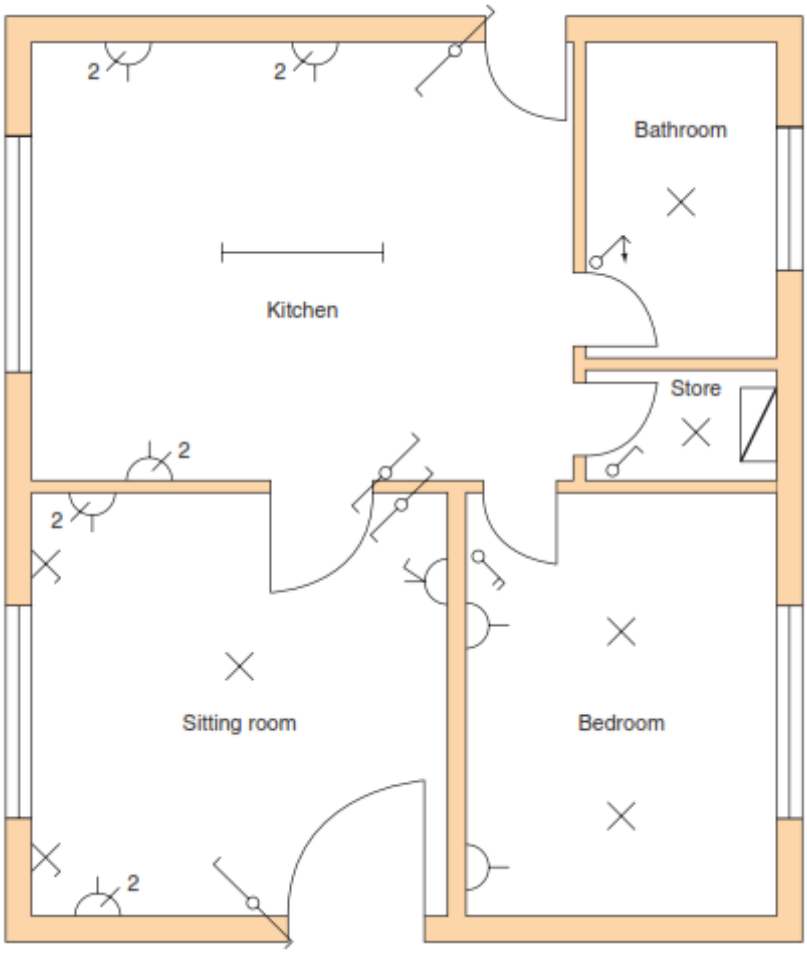


Fig.1 Layout drawing or site plan for electrical installation.

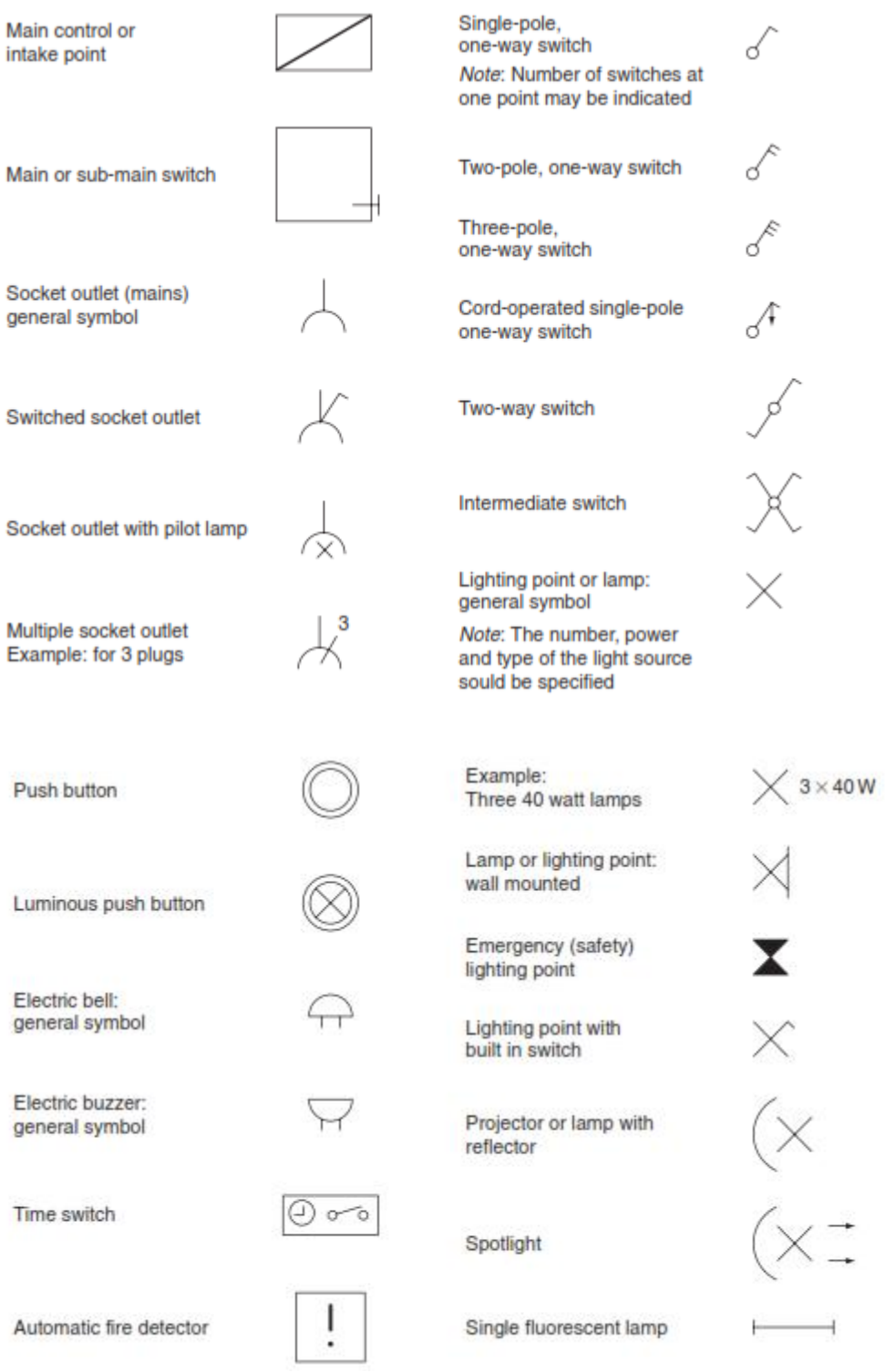

Main control or intake point
Main or sub-main switch
Socket outlet (mains) general symbol
Switched socket outlet
Socket outlet with pilot lamp
Multiple socket outlet Example: for 3 plugs
3
Push button
Luminous push button
Electric bell: general symbol
Electric buzzer: general symbol
Time switch
Automatic fire detector
Single-pole, one-way switch
Note: Number of switches at one point may be indicated
Two-pole, one-way switch
Three-pole, one-way switch
Cord-operated single-pole one-way switch
Two-way switch
Intermediate switch
Lighting point or lamp: general symbol
Note: The number, power and type of the light source sould be specified
Example: Three 40 watt lamps
3 × 40 W
Lamp or lighting point: wall mounted
Emergency (safety) lighting point
Lighting point with built in switch
Projector or lamp with reflector
Spotlight
Single fluorescent lamp

Fig 2 Electrical installation symbols according to British standard.

2. AS-FITTED DRAWINGS

When the installation is completed a set of drawings should be produced which indicate the final positions of all the electrical equipment. As the building and electrical installation progresses.

3. DETAIL DRAWINGS AND ASSEMBLY DRAWINGS

These are additional drawings produced by the architect to clarify some point of detail. For example, a drawing might be produced to give a fuller description of the suspended ceiling arrangements.

4. SCHEMATIC DIAGRAMS

A **schematic diagram** is a diagram in outline of, for example, a motor starter circuit. It uses graphical symbols to indicate the interrelationship of the electrical elements in a circuit. These help us to understand the working operation of the circuit.

An electrical schematic diagram looks very much like a circuit diagram. A mechanical schematic diagram gives a more complex description of the individual elements in the system, indicating, for example, acceleration, velocity, position, force sensing and viscous damping.

5.BLOCK DIAGRAMS

A **block diagram** is a very simple diagram in which the various items or pieces of equipment are represented by a square or rectangular box.